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REPORT ON THE 1990 COOPERATIVE NORTH PACIFIC ALBACORE OBSERVER PROJECT

By

Norman Bartoo, David Holts, and Cheryl Brown

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ADMINISTRATIVE REPORT LJ-91-09

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REPORT ON THE 1990 COOPERATIVE NORTH PACIFIC ALBACORE OBSERVER PROJECT

Norman Bartoo, David Holts and Cheryl Brown
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The Southwest Fisheries Science Center (SWFSC) in cooperation with members of the Western Fishboat Owners Association (WFOA) placed fisheries observers on cooperating U.S. troll vessels fishing in the north Pacific in 1990. This effort was a part of a comprehensive impact assessment program on the effects of the high-seas drift net fisheries on the north Pacific albacore (*Thunnus alalunga*) stocks and other fisheries. Albacore that encounter drift nets and escape bear some external marks that can subsequently identify it (to a greater or lesser extent) in the troll catch, provide direct evidence of interaction when caught in the troll fishery. In this report, the results of the observer project are described.

BACKGROUND

Catches and catch-per-effort from the U. S. albacore troll and pole-and-line fisheries in the north Pacific, have declined since the mid-1970's (Coan et al. 1991; Kleiber and Perrin 1991). In addition to the U. S. fishery, Japan and Taiwan each have a surface fleet and a longline fleet catching albacore in the north Pacific. Three high-seas drift net fleets are also currently known to be catching albacore in the north Pacific (Annon. 1989).

The small mesh drift net fleets are made up of vessels from Japan, Taiwan and the Republic of Korea (ROK). The Japanese and Taiwan fleets fish for flying squid (*Ommastrephes bartrami*) and use small 90 to 120mm stretched mesh nets in the north Pacific Transition Zone from about May through December. The ROK fleet operates in the Transition Zone as well but during the entire year with approximately the same mesh sizes as the Japanese fleet. The incidental catches of albacore by these drift net fisheries are not precisely known.

The large mesh drift net fleet is made up of vessels from Japan and Taiwan. Japan's fleet, using 160 to 180mm stretched mesh (Bartoo and Holts, 1991), is currently restricted to areas east of 170° E. Albacore is a major component of that catch. Taiwan has a developing large mesh fishery for albacore using approximately the same mesh sizes as the Japanese fleet. The impact of these fleets on albacore is largely unknown. Both Taiwan and Japan have imposed internal regulations on their drift net fleets in order to limit fishing effort in the higher latitudes west of 170° E longitude to minimize interceptions of high seas salmon.

Although drift net landings are incomplete, the aggregate estimated annual landings for all fisheries is approximately 15,000 mt to 30,000 mt of albacore annually from the north Pacific.

Scientists began receiving input from U. S. albacore fishermen in the late 1980's about increasing numbers of albacore injured or scared by encounters with high-seas drift nets. Concerns focused on the impact of drift net fisheries on the north Pacific albacore stock and the direct interaction with the U.S. albacore troll fleet.

1990 OBSERVER PROJECT

In 1990, SWFSC biotechnicans observed 6 complete fishing trips aboard 5 different troll vessels. Vessels selected for observation were chosen to provide data from beginning to end of the season as well as spatially covering the fishery. Observers documented daily catches and profiled drift net inflicted damage on albacore caught during trolling operations over a wide area of the north Pacific Ocean (Figure 1).

The goal was to provide an (minimum) estimate of the magnitude of direct interaction between high-seas drift net and U. S. troll fisheries, and to provide biological information from which delayed mortality of albacore due to net encounters might be inferred. Specific objectives are as follows:

A. Describe the type and severity of drift net damage on troll-caught albacore

B. Estimate the relative frequency of undamaged albacore and damaged albacore

C. Estimate the size-frequency of undamaged albacore and damaged albacore

D. Determine the relative physiological condition of troll-caught albacore that show gill net damage

METHODS

The marks left on a fish after an encounter with a drift net are most visible just after being caught and boated during trolling operations. Most marks cannot be seen once the fish is frozen. Observers were instructed to examine each fish boated and note marks on the fish which could be identified as net scares or marks. Observers were provided a set of common reference photographs detailing the type and severity of injuries (Figure 2). These were coded as follows:

Code	Damage Description
0	No gill net damage to fish
1	Minor damage along side(s) of fish, pattern of stripes due to minor scale loss where fish forces its way through or along the net.
2	Minor damage to head, chiefly forwards of pectoral fins, brush like pattern of scale loss.

3 Severe damage with bruising or scraping away of parts of the skin, primarily in area of greatest girth and mostly on dorsal surface.

4 Old gill net damage of any degree that is partially or completely healed. These are assumed to have occurred in the previous fishing season.

In addition to damage code, observers collected information on fork lengths, maximum girth, and weights for as many fish as possible. Fishing operations usually continued all day from first light to just after dark. Blood and biological samples were collected whenever possible for studies of delayed mortality resulting from observed injuries. One vessel (Cruise 4) semi-processed the catch as fish came aboard. This allowed for additional collections of biological material.

RESULTS

Six cruises totaling 377 observed sea days were completed between the end of May and the end of October 1990. This included observations from the north Pacific Transition Zone north of Midway Island, the offshore and coastal fishing grounds (Figure 1). A total of 25,177 albacore were caught and boated during the cruises. Seventy-eight percent of these (19,526) were examined for drift net related injuries and were measured for both fork length and maximum girth. A total of 8,720 fish were weighed to the nearest pound. Catch-per-observed days fishing averaged 66.8 fish-per-day but varied considerably between cruises (Table 1). One vessel (Cruise 5) was on a charter with WFOA as a scout boat and did not conduct routine fishing operations.

Three distinct size modes were caught throughout the north Pacific apparently representing age 2, 3, and 4 year old fish (Figure 3). Length modes were centered at 54 cm, 65 cm and at 80 cm (3.5 kg, 5.7 kg, and 10.6 kg).

Overall, 87.6% of the observed catch showed no evidence of net related damage (Table 2). Recent gill net damage (damage codes 1,2 & 3) totaled 7.2% while an additional 5.2% had healed scars from net encounters during the previous fishing season (code 4). Within the recently damaged albacore, 3.0% had minor damage where they squeezed through a mesh or scraped along the net sustaining only minor lateral scratches and scale loss, 3.6% had moderate injuries on the head, gill covers and fins while 0.6% had severe bruising with significant loss of scales with skin damage to their head, sides and fins.

11,868 albacore were measured for fork length (FL) east of 140° W and 7,675 more were measured west of 140° W. The catch taken west of 140° W had a larger percent of large fish than the catch east of 140° W (Figure 4). These large fish averaged 9 - 11 kg (20 to 25 lbs) and were taken in June and the first two weeks of July. Although the sample size was small, injuries from recent encounters with drift nets were observed on nearly 18% of the catch. Old and healed scars from the previous season appeared on less than one percent of the catch west of 160° W but increased to about 5% east of 160° W (Table 2).

By the end of July, all observed vessels were fishing east of 140° W and south of 50° N, catching fish weighing 5 - 9 kg (12 to 20 lbs). These fish were caught throughout the month of August and early September. The incidence of fresh injuries remained at about 6.7% in the coastal areas and the incidence of old injuries remained fairly constant at about 5 percent.

Albacore taken north of 50° N had a higher proportion of large (80 cm fork-length) fish than those caught east of 140° W and south of 50° N (Figure 4). No fish less than 63 cm FL were sampled north of 50° N. Fishing remained moderately good north of 50° N until seasonal storms out of the Gulf of Alaska forced many fishing vessels to return home by the end of September. Few recently damaged fish were observed north of 50° N although the proportion of old and healed damage changed little from that seen just off Washington and Oregon (5.5% to 4.9% respectively).

The observed length frequencies varied considerably in different fishing locations. Length frequencies of injured fish did not vary significantly from uninjured fish within each area examined. The length frequencies, by area, for undamaged (code 0), recently damaged (codes 1-3) and old damage (code 4) are shown in figures 5, 6 and 7 respectively. No previous damage estimates are available from the 1989 season that could help describe survival of fish sampled (code 4) in the 1990 fishing season. It would seem plausible that at least 5.2% of the fish did survive a previous gill net encounter.

The length-weight relationship for all 8,720 weighed albacore is shown in Figure 8. Analysis of weight data with the frequency and severity of injuries did not indicate any significant weight loss due to those injuries; however, sample size was small for some size categories.

Success of catching and landing a fish after a jig strike was sampled on two cruises. During 49 fishing days (Cruise 3), 3,459 jig strikes resulted in 79.1% (95% C. I. of 75.8% to 82.5%) successfully landed albacore. During Cruise 6, observation periods of one hour each on six different days produced 56 jig strikes. Of these, 83.9% of the strikes resulted in successful landings. Condition of albacore not landed could not be determined although some bleeding was noted.

Blood and tissue samples were collected from sub-groups of healthy and injured fish, including fish that had recovered from previous injuries, to determine if disease or other clinical problems were occurring in the injured fish. A total of 80 blood samples were taken from undamaged albacore, 37 from recently injured and 51 from albacore with old injuries. Ovary samples were taken from 61 albacore in the north Pacific Transition Zone and offshore areas to determine reproductive readiness. The results of these analysis will be reported elsewhere.

Weather, sea state and other oceanographic conditions were documented up to three times per day. Satellite transmitters were onboard Cruises 2, 4 and 6 and were used to report real time meteorologic data on a daily basis.

Marine mammal and turtle sightings were routinely documented on standard Marine Mammal Observation Forms. A summary of sightings follow:

Species	Sightings
Pacific white sided dolphin	984
Northern right whale dolphin	390
Dalls porpoise	172
Common dolphin	142
Rissos dolphin	55
Pilot whale	26
Sperm whale	3
Bottle nosed dolphin	2
Killer whale	2
Fur seal	1
Elephant seal	1
Unidentified dolphin	124
Unidentified whale	13
Unidentified turtle	1

CONCLUSIONS

The use of observers in cooperation with U.S. troll vessels has allowed the collection of a unique data set which would otherwise be impossible.

From the data collected it is apparent that a relatively large average percentage of the fish sampled (7.2%) showed evidence of recent encounters with drift nets. The apparent "gradient" in proportion of net marked fish from west to east is unexplained. Specific causes for this gradient are unknown, however there are two possible explanations.

First, there is probably an unmeasured fishing mortality associated with encountering and escaping a drift net (alive) which reduces the number of albacore available to be recaptured in the troll fishery. This would logically seem to increase directly with the severity of injury and passage of time. This is supported by the fact that the proportion of fish captured with minor and moderate damage (codes 1 and 2) are 3.0% and 3.6%, respectively while the proportion of severely damaged fish (code 3) is less, 0.6%.

Second, the migration pattern of north Pacific albacore may be such that a considerable proportion of the population is not available at the extreme east end of the population distribution (the U.S. west coast). The observed decline in recent injuries decreasing west to east (especially north of 50° N) suggests this is possible. Tagging evidence shows that at least some portion of the population does make a migration from extreme eastern Pacific to extreme western Pacific. The relatively constant proportion of old marks east of 160° W, both north of 50° N and the inshore areas are contrasted with the low proportions west of 160° W.

There may be a relatively low loss rate of live fish following a drift net encounter. This may be true for large mesh drift nets, but logically does not seem to be the case for small mesh drift nets since these nets tend to capture fewer albacore of the age classes observed during

these cruises. This cannot be supported, except by logic because it is only possible to say that the severely damaged fish (0.6%) encountered a large mesh net; all the other marked fish, with both fresh and old marks, could have encountered either large or small mesh nets.

ACKNOWLEDGEMENTS

We wish to thank Bill Perkins and Art Hayworth of the Western Fishboat Owners Association for their help in locating owners of fishing vessels for placement of our observers. We also to thank the owners of those vessels; Brent Bixler, Stan Davis, John Gouph, Don Hanlon, and Kyle Vanderpool for their support. We are truly indebted to the observers John Childers, Mike Ellenburger, Tod Enselon, Ed Fisher, Sam Modugno and Greg Yee who examined and measured the nearly 20,000 albacore. Doug Prescott assisted with software and programming services, Ken Raymond, Roy Allen and Karen Handschuh provided the figures, and Karen Handschuh typed the manuscript.

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Table 1. Albacore catch-per-days fishing in numbers of fish by cruise. Confidence intervals calculated on mean catch per days fished.

CATCH (NUMBERS) PER DAYS FISHING

Cruise	Mean	Range	SD	95% C.I.
Cruise 1	108	0 - 634	146.3	76.01 - 139.9
Cruise 2	68	0 - 363	91.3	48.47 - 88.1
Cruise 3	88	0 - 291	58.5	74.02 - 101.3
Cruise 4	48	1 - 122	30.1	39.20 - 56.5
Cruise 5	10	0 - 100	22.8	2.63 - 18.3
Cruise 6	58	0 - 375	82.7	20.02 - 95.3

Table 2. Percent of albacore by fishing area damaged during encounters with drift nets and caught by troll vessels.

DAMAGE TYPE	FISHING AREA				
	WEST OF 160°W	160°W TO 140°W	NORTH OF 50°N	EAST OF 140°W AND SOUTH OF 50°N	ALL AREAS
NO DAMAGE	81.2	82.8	94.1	88.4	87.6
NEW DAMAGE					
CODE 1	6.0	4.9	0.0	3.0	3.0
CODE 2	11.5	6.3	0.4	2.7	3.6
CODE 3	0.5	0.5	0.0	1.0	0.6
TOTAL NEW DAMAGE	17.9	11.7	0.4	6.7	7.2
OLD DAMAGE	0.9	5.5	5.5	4.9	5.2
SAMPLE SIZE, n	218	7,440	4,800	7,068	19,526

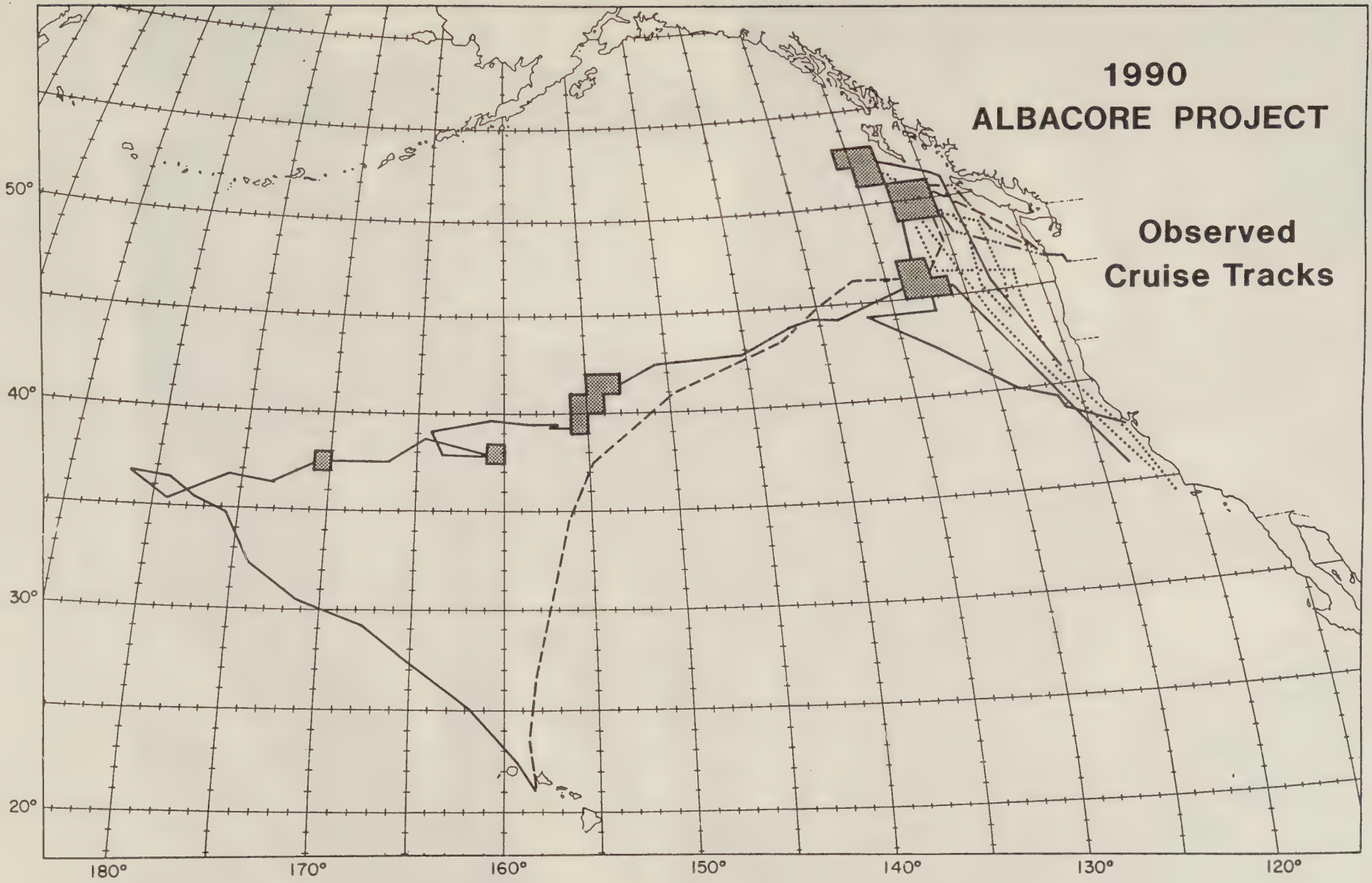

Figure 1. General cruise track and fishing areas (shaded areas) for observed albacore troll vessels. Three vessels departed Honolulu and three departed from the mainland. All cruises terminated on the west coast.

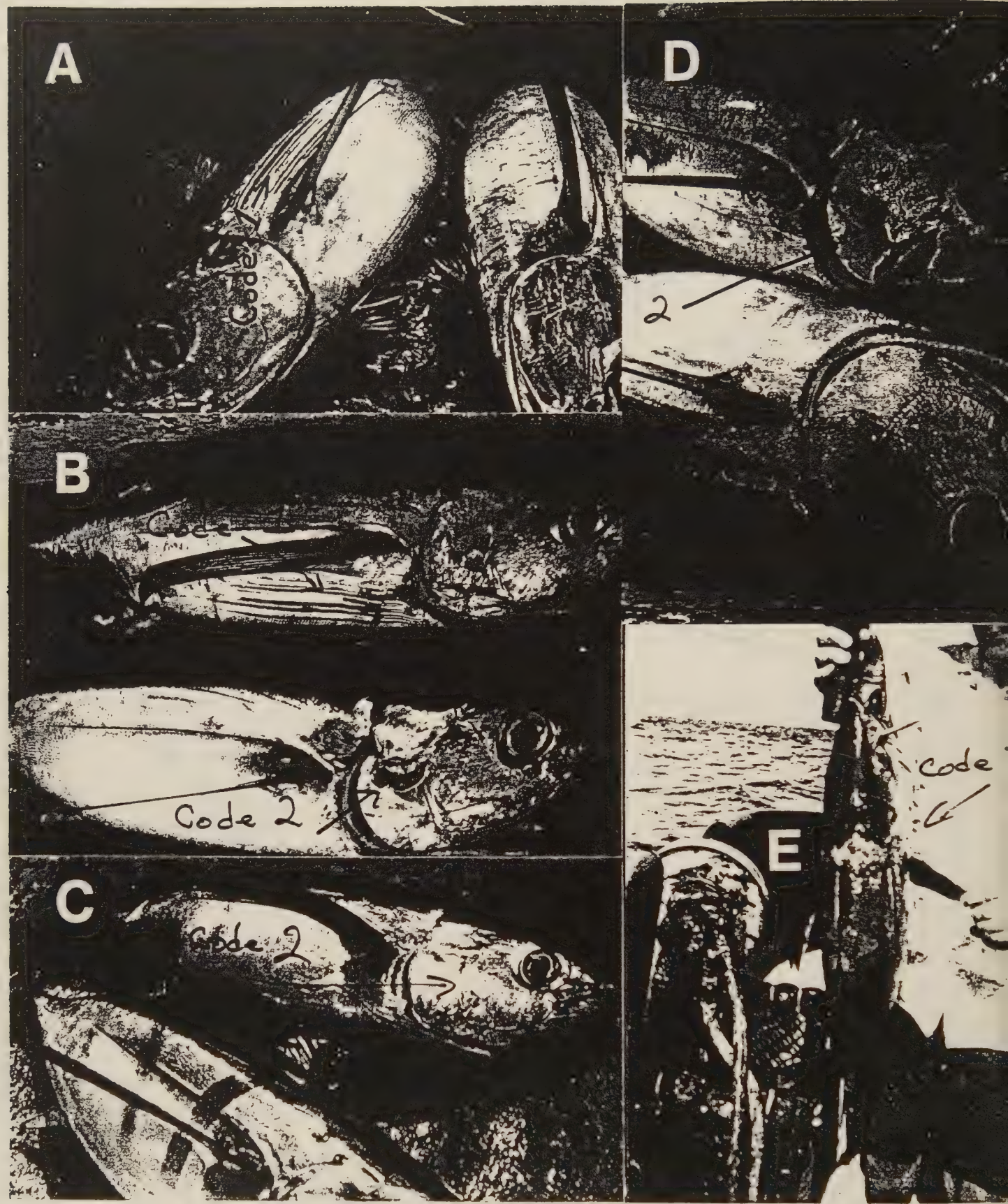

Figure 2. Pacific albacore damaged by high-seas drift nets. Damage code 1 indicates minor scratches and scale loss (A & B). Damage code 2 shows moderate damage on the head (B, C & D). Damage code 3 indicates significant loss of scales or skin (E).

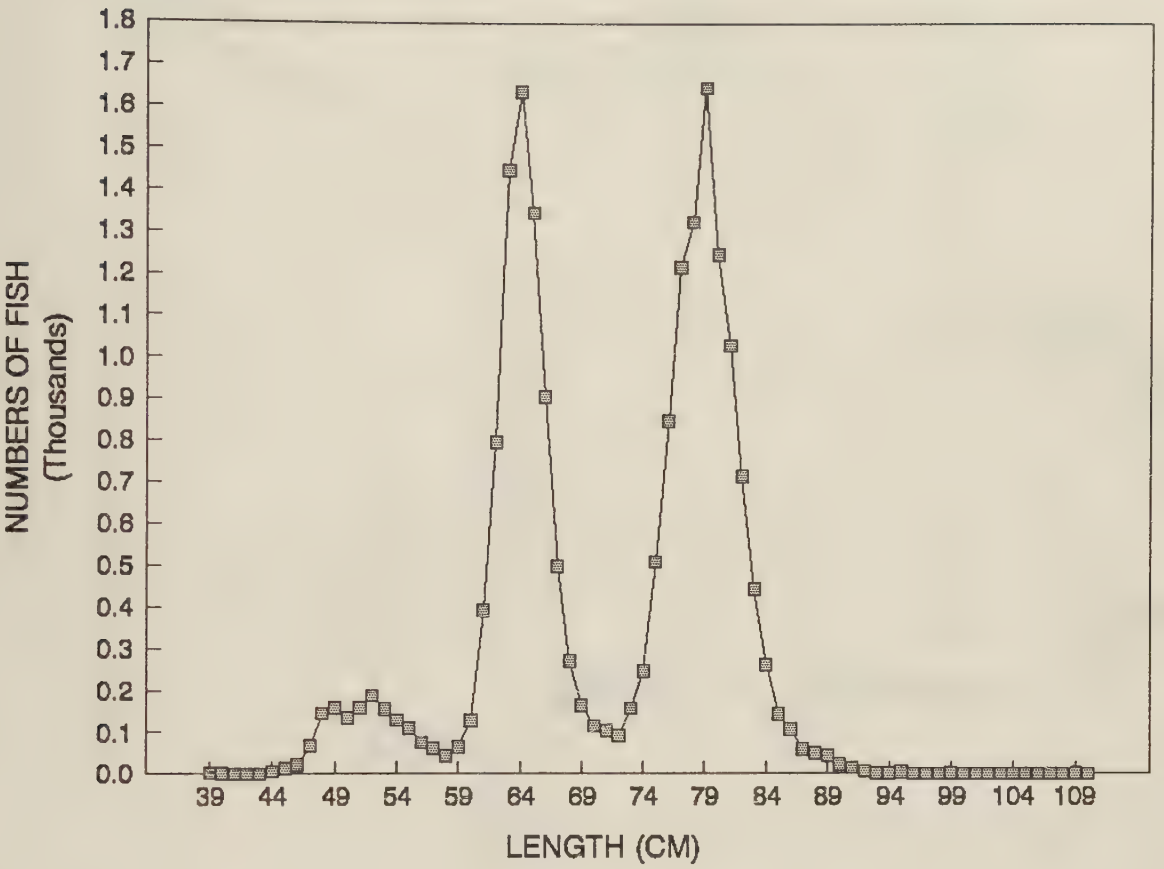

Figure 3. Length frequency of 19,526 albacore measured during the troll fleet observer program.

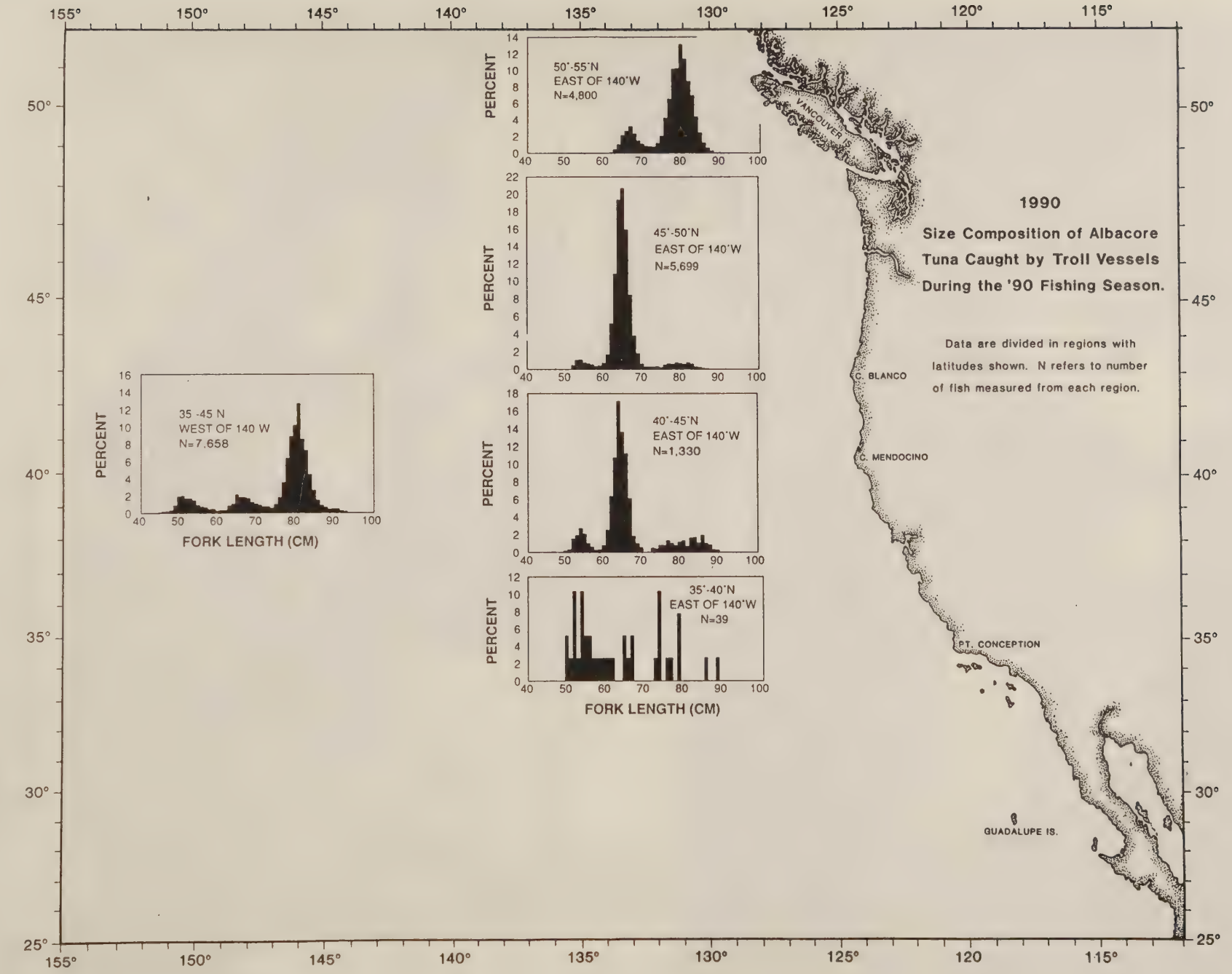

Figure 4. Albacore length frequencies by fishing areas of the north Pacific.

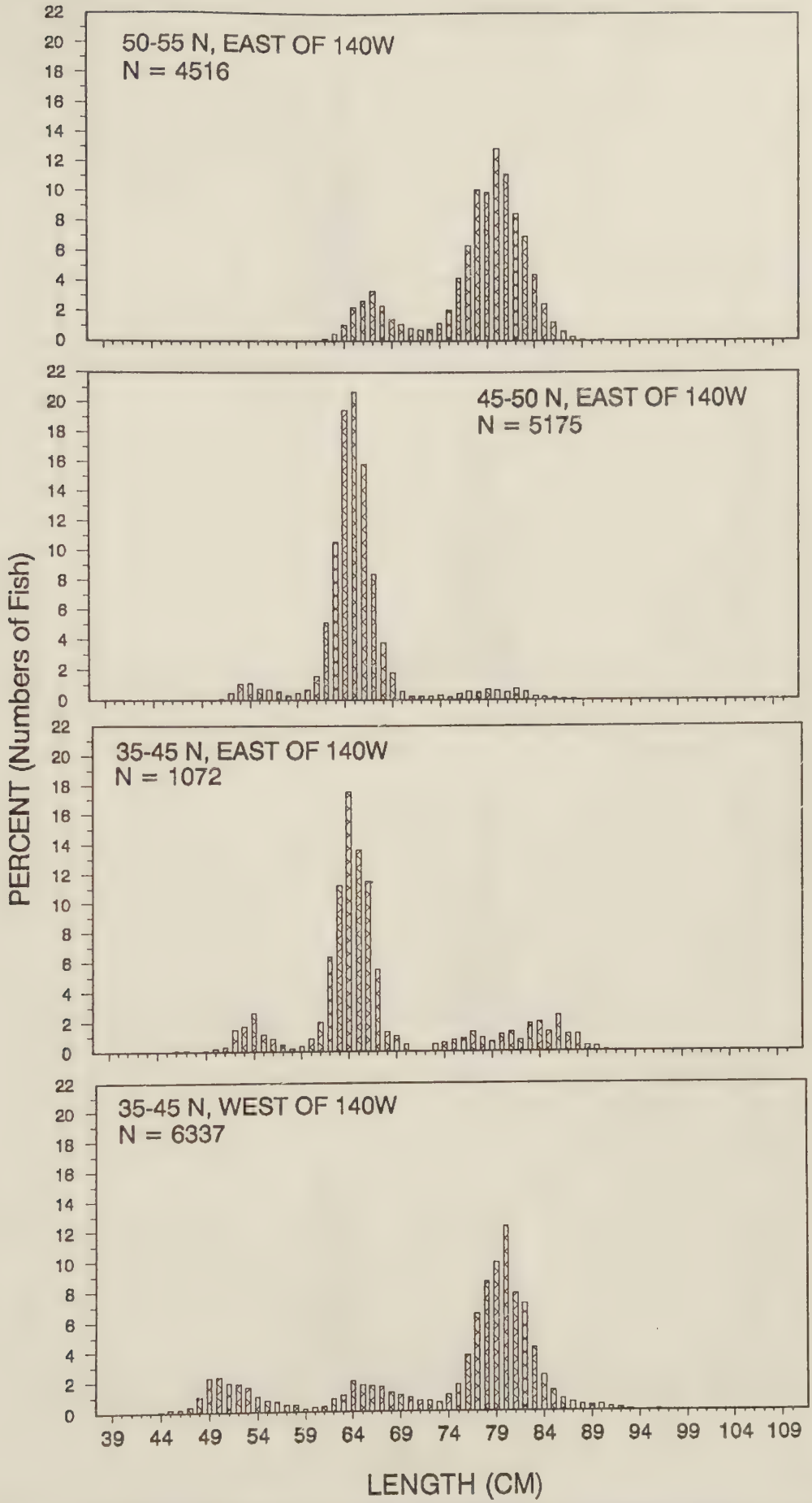

Figure 5. Length frequencies of un-damaged albacore (Code 0) from the four fishing areas of the north Pacific.

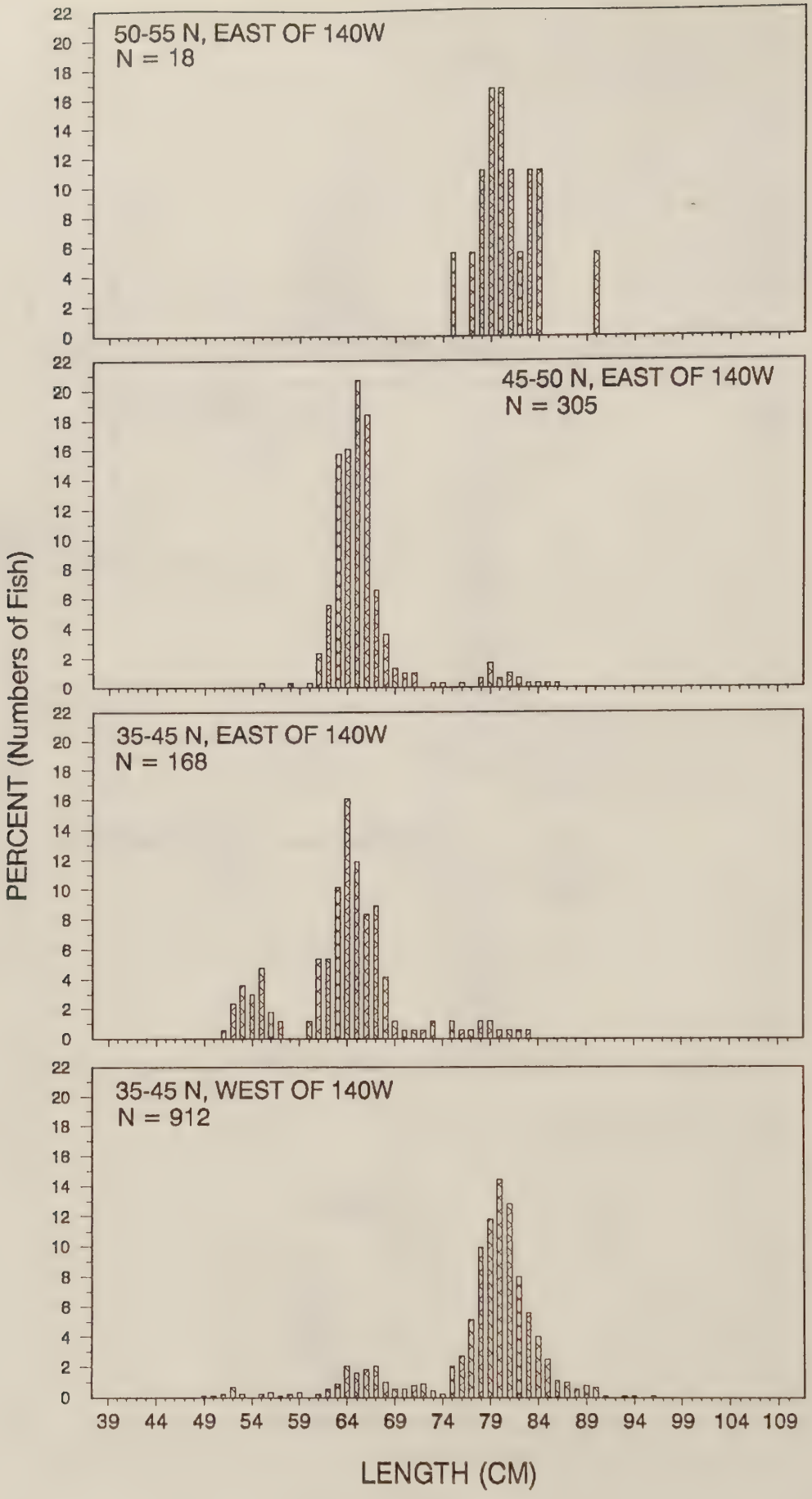

Figure 6. Length frequencies of recently damaged albacore (Codes 1, 2, and 3) from the four fishing areas of the north Pacific.

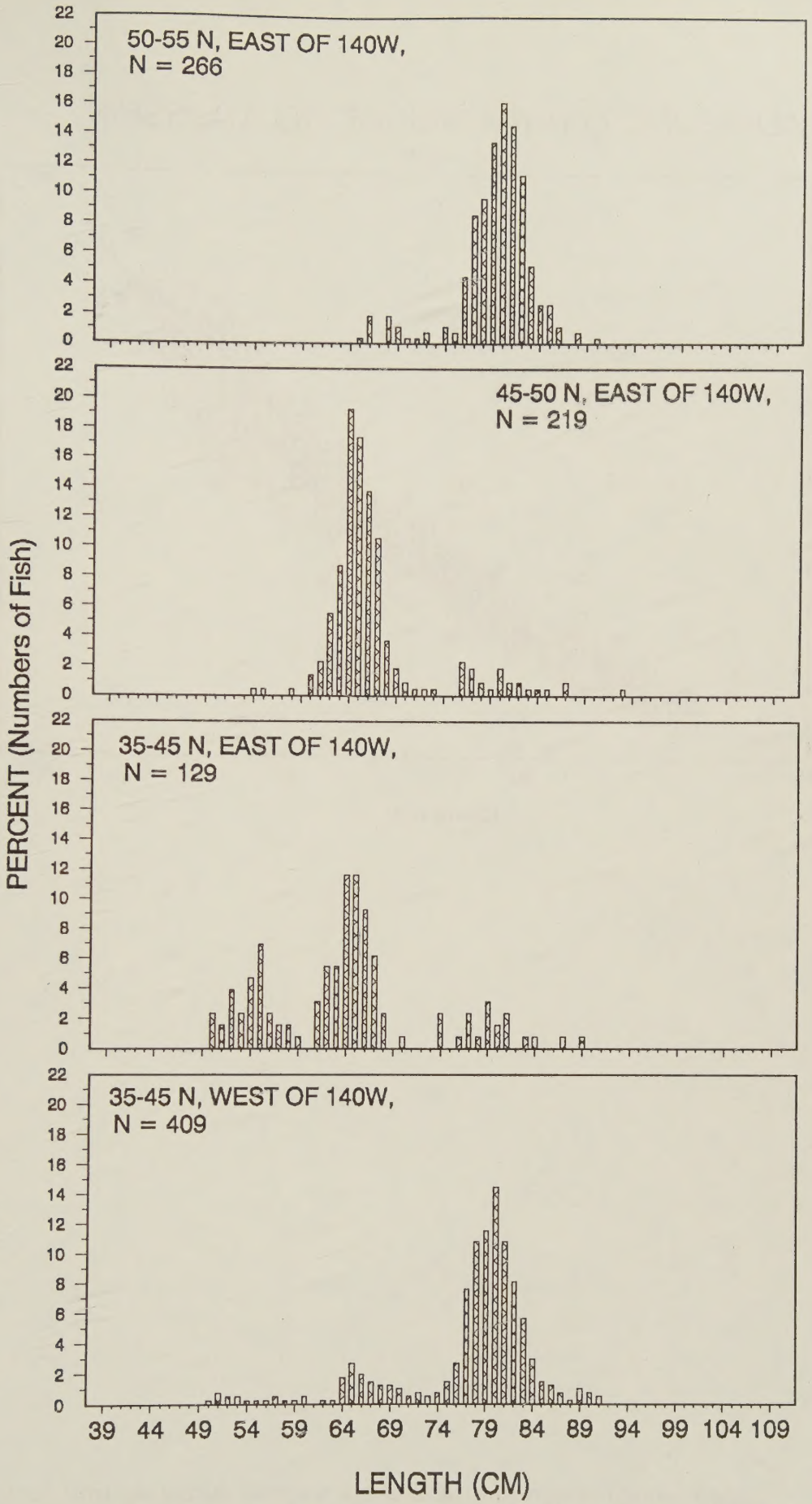

Figure 7. Length frequencies of albacore with old injuries (Code 4) from the four fishing areas of the north Pacific.

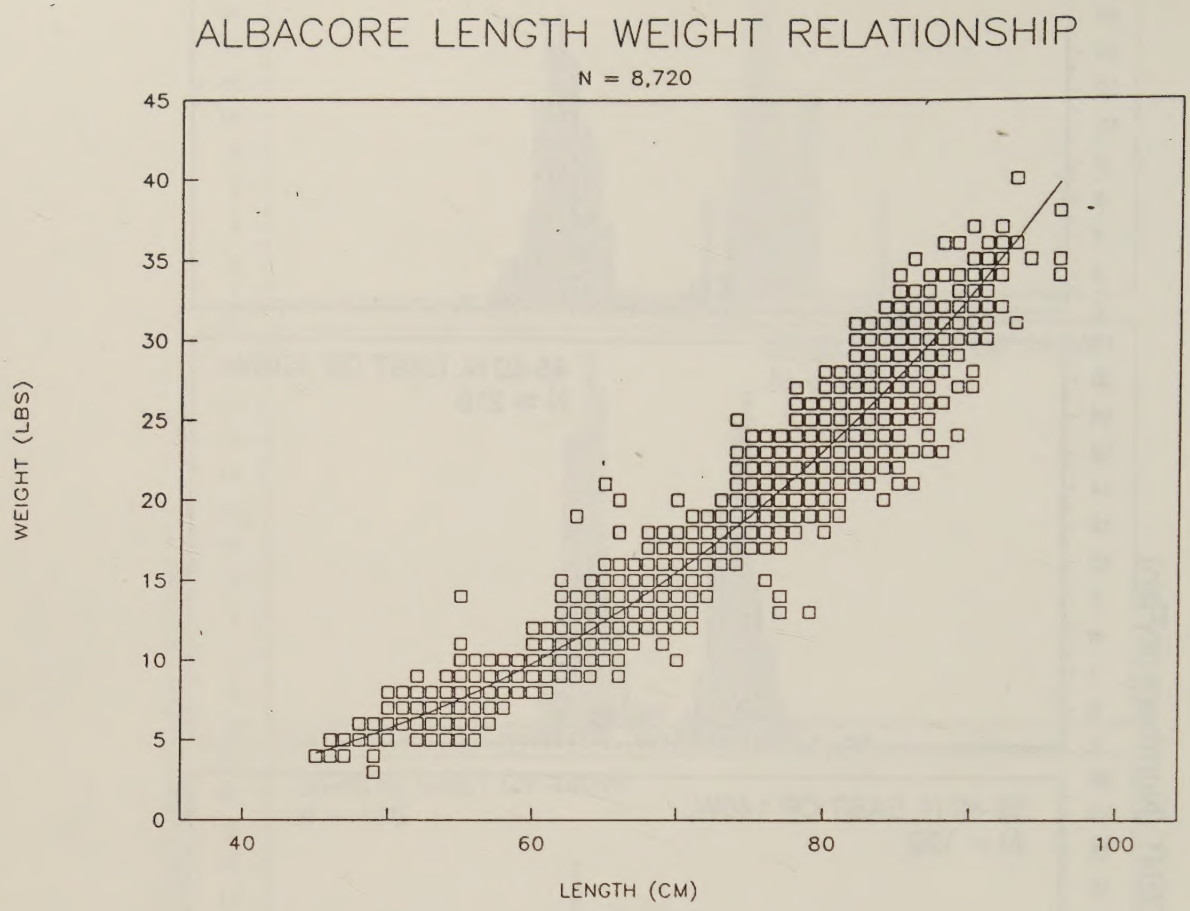

Figure 8. Length-weight relationship of albacore weighed during the troll fleet observer program.